MODULAR AIR GAP DEVICE AND FAUCET INCLUDING SAME

Cross-Reference to Related Applications

This application claims priority from and benefit of the filing date of U.S. provisional application no. 60/402,506 filed August 9, 2002 and U.S. provisional application no. 60/421,730 filed October 28, 2002, and the disclosures of both said provisional applications are hereby expressly incorporated by reference herein.

Background

Air gap devices are well known and in widespread use. These devices are placed in a water line upstream from a drain to prevent siphoning of water from the drain into a water system.

Known air gap devices have been deemed deficient for a variety of reasons. Many known air gap devices are located in a water line in an inconvenient location. Others have been connected to a faucet, but have not been received within the faucet body. As such, these prior faucet-mounted air gap devices have altered the dimensions (e.g., elevation above a mounting surface) and appearance of a faucet.

In light of these drawbacks and others associated with known air gap devices, it has been deemed desirable to develop a modular air gap device and faucet including same, wherein the air gap device is selectively housed within the faucet body, as needed, so that the external appearance of the faucet is unchanged by the installation of the air gap device therein.

Summary of the Preferred Embodiment

In accordance with a preferred embodiment, a modular air gap device is adapted for selective insertion into an associated faucet body and comprises a base, an inlet nipple defining an inlet passage and an outlet nipple defining an outlet passage. The inlet and outlet nipples project outwardly from the base in a first direction. An air gap structure is connected to the base and projects outwardly therefrom in a second direction opposite the inlet and outlet nipples. The base and

air gap structure are adapted for receipt within an air gap chamber of a faucet body. The air gap structure defines a flow path having a first end in direct fluid communication with the inlet passage of the inlet nipple and a second end spaced from the outlet passage of the outlet nipple so that an air gap is defined between the second end of the flow path and the outlet passage.

In accordance with another preferred embodiment, a modular air gap device comprises: (i) a base adapted for receipt within an associated faucet body. The base comprises a first side and an opposite second side. The modular air gap further includes: (ii) a waste water inlet nipple projecting outwardly from the second side of the base and defining a waste water inlet passage projecting; (iii) a waste water outlet nipple projecting outwardly from the second side of the base and defining a waste water outlet passage; and, (iv) a pool defined by a wall extending upwardly from the first side of the base, wherein the waste water outlet passage is in fluid communication with the pool. The device further comprises a conduit comprising a first end in fluid communication with the waste water inlet passage and a second end spaced from and aligned vertically with the pool so that an air gap is defined between the second end of the conduit and the pool so that liquid that flows from the second end of the conduit is received in the pool and flows therefrom via the waste water outlet passage.

In accordance with another preferred embodiment, a faucet comprises a body defining: (i) an inlet; (ii) an outlet; (iii) a valve chamber located fluidically between the inlet and the outlet; (iv) an air gap chamber that opens in a first end of the body; and, (v) a vent defined through a wall of the body into the air gap chamber. A valve is located in the valve chamber to control flow of liquid from the inlet to the outlet. A modular air gap device comprises: (i) a base; (ii) an inlet nipple defining an inlet passage and an outlet nipple defining an outlet passage, wherein the inlet and outlet nipples project outwardly from the base in a first direction; and

(iii) an air gap structure connected to the base and projecting outwardly therefrom in a second direction opposite the first direction. The base and the air gap structure are located within the air gap chamber of the body. The air gap structure defines a flow path having a first end in fluid communication with the inlet passage of the inlet nipple and a second end spaced vertically from the outlet passage of the outlet nipple so that an air gap is defined between the second end of the flow path and the outlet passage. The inlet and outlet nipples extend outwardly relative to the first end of the body while the air gap structure is located within the air gap chamber of said body.

In accordance with another embodiment, a faucet comprises a body defining an inlet, an outlet, a valve chamber, and air gap chamber defined between the inlet and a first end of the body. A valve assembly is installed in the valve chamber for controlling flow of liquid from the inlet to the outlet. An air gap device is removably installed within the air gap chamber of the body. The air gap device comprises an inlet nipple and an outlet nipple, wherein both the inlet and outlet nipples extend outwardly from a first end of the body and wherein all portions of the air gap device that are located between the first end of the body and the inlet are housed completely within the air gap chamber of the body. The air gap device is selectively removable from the air gap chamber of the body without altering an external appearance of the body.

Brief Description of the Drawings

The invention comprises various components and arrangements of components, preferred embodiments of which are illustrated in the accompanying drawings that form a part herein and wherein:

FIGURE 1 is a front elevational view of a faucet body conformed to receive a modular air gap device in accordance with the present invention;

FIGURE 2 is a top plan view of the faucet body shown in FIGURE 1;

FIGURE 3 is a bottom view of the faucet body shown in FIGURE 1;

FIGURE 4 is a sectional view taken along line 4-4 of FIGURE 1;

FIGURE 5A is a sectional view of a complete faucet assembly adapted to receive a modular air gap device formed in accordance with the present invention;

FIGURE 5B is identical to FIGURE 5A but shows a modular air gap device installed within the faucet assembly in accordance with the present invention;

FIGURE 6 is a front elevational view of a modular air gap device formed in accordance with the present invention;

FIGURE 7 is a top plan view of the modular air gap device shown in FIGURE 6;

FIGURE 8 is a side elevational view of the modular air gap device shown in FIGURE 6;

FIGURE 9 is a bottom plan view of the modular air gap device shown in FIGURE 6;

FIGURE 10 is a sectional view taken along line A-A of FIGURE 8;

FIGURE 11 is a sectional view taken along line B-B of FIGURE 6;

FIGURE 12 is a perspective illustration of the modular air gap device of FIGURE 6;

FIGURE 13 is a top plan view of an alternative modular air gap device formed in accordance with the present invention;

FIGURE 14 is a front elevational view of the modular air gap device shown in FIGURE 13;

FIGURE 15 is a side elevational view of the modular air gap device shown in FIGURE 13; and,

FIGURE 16 is a view similar to FIGURE 14 but shows the modular air gap device installed in a faucet body in accordance with the present invention, with portions of the faucet body and air gap device broken away.

Detailed Description of Preferred Embodiments

FIGURES 1-4 illustrate a faucet body **20** defined from metal, plastic or the like and including a liquid inlet **22** and a liquid outlet **24**. The inlet **22** and outlet **24** are threaded or otherwise adapted to mate in a fluid-tight manner with conventional conduit and/or fittings.

As shown in FIGURE 5A, a gooseneck outlet conduit **G** is mated with the outlet **24**. A mounting tube **MT** is mated with the inlet **22**. A plastic or other supply conduit **SC** extends through the mounting tube **MT** and includes a fitting **IF** at its inner end that is secured in said inlet **22** by said mounting tube **MT**.

With continuing reference to FIGS. 1-5A, the body **20** defines a valve chamber **30** including an open mouth **32** that is also threaded. The valve chamber **30** fluidically interconnects the inlet **22** and outlet **24**. The valve chamber **30** is conformed to receive a valve assembly **VA** (FIG. 5A) such as a conventional 1/4-turn ceramic disk cartridge valve assembly or any other suitable conventional valve assembly that controls and selectively blocks liquid flow from the inlet **22** to the outlet **24**. In the illustrated embodiment, the valve assembly **VA** threadably mates with the threads defined by the mouth **32**.

The faucet body **20** further defines a hollow air gap chamber **40**. The air gap chamber **40** includes a mouth **42** that opens in a first end **44** of the body **20**, and the chamber extends from the mouth **42** toward the inlet **22**. The body **20** preferably defines a vent opening **28** that intersects the air gap chamber **40**. The vent opening **28** is typically required when a modular air gap device **50** (FIGS. 6-11) is operatively installed in the chamber **40** as described below and as shown in FIG. 5B. A removable cap (not shown) is used to block the vent opening **28** when venting of the chamber **40** is not required.

A faucet assembly **F** comprising the body **20** is illustrated in FIGURE 5A.

The faucet assembly **F** is adapted to be mounted to a sink **S** or other support surface. In particular, the mounting tube **MT** including the supply conduit **SC** is inserted through an opening **O** defined in the sink **S** so that the first end **44** of the body **20** mates with the sink **S** or an intermediate gasket such as a rubber washer or other gasket member **43** that is preferably positioned between the first end **44** of the body **20** and the sink **S** as shown. On the underside of the sink **S** or other mounting structure, a first washer **W1**, spacer **SP**, second washer **W2** and nut **N** (or another suitable arrangement of fastening members) are used to clamp the faucet assembly **F** to the sink **S** as shown when the nut **N** is threaded onto the mounting tube **MT**. Of course, the supply conduit **SC** is connected to a source of water or other liquid so that same flows into the inlet **22** and from there to the outlet 24 via valve chamber **30** as controlled by valve assembly **VA**. Valve assembly **VA** comprises a handle **H** by which a user manually opens and closes the valve assembly.

FIGURE 5B illustrates the faucet assembly **F** and further shows a modular air gap device **50** formed in accordance with the present invention operatively installed in the chamber **40** of the faucet body **20**. In the preferred embodiment, the modular air gap device **50** is simply placed in the chamber **40** as shown in FIGURE 5B and is trapped and held therein when the faucet body **20** is mated with a sink **S**, counter-top or other support surface when installed as described above in relation to FIGURE 5A, i.e., the sink or other mounting structure blocks the mouth 42 of the air gap chamber 40. It is important to compare FIGURES 5A and 5B and note that the modular air gap device **50** does not alter the appearance or dimensions of the body **20** or position of the faucet body **20** same relative to sink **S** or other mounting surface.

The modular air gap device **50** is shown separately in FIGURES 6-12 and comprises a body **52** preferably defined from molded plastic or another suitable

material. The body **52** is preferably one-piece and comprises a base **54** dimensioned and conformed to be at least partially received in the mouth **42** of the chamber **40** of the faucet body **20**. The base **54** defines a flange **56** adapted to engage the faucet body **20** when the device **50** is operatively installed in the chamber **40**.

The body **52** of the air gap device **50** further comprises an air gap structure **60** projecting outwardly from a first side of the base **54**. A wall **54w** also projects outwardly from the first side of the base **54** and defines an open-top pool **P**. As shown, the wall **54w** at least partially encircles the air gap structure **60**.

In the illustrated embodiment, the air gap structure **60** comprises a vertically extending support member **61** projecting outwardly from the base **54**. The support member **61** defines a recessed distal end **62**. The air gap structure **60** further comprises an air gap conduit or tube **70** that is seated in the recessed distal end **62** of the support member **61**. The conduit **70** is preferably a metal tubular member that is assembled to the body **52** of the device **50** but can be a molded plastic member and can be defined as a one-piece construction with the remainder of the air gap structure **60**.

The body **52** further defines a waste water inlet nipple **80** projecting outwardly from a second side of the base **54** in a direction opposite that in which the air gap structure **60** projects. A waste water inlet passage **82** extends through the inlet nipple **80**. The waste water inlet passage **82** includes in inlet port **84** and an outlet port **86** (FIG. 10). A waste water supply line (not shown) is connected to the inlet nipple **80**.

Similarly, the body **52** defines a waste water outlet nipple **90** projecting outwardly from a second side of the base **54** in a direction opposite that in which the air gap structure **60** projects. A waste water outlet passage **92** extends through the

outlet nipple **90**. The waste water outlet passage **92** includes an inlet port **96** and an outlet port **94** (FIG. 10), and the inlet port **96** opens in the pool **P**, preferably at a lowest point thereof so that all liquid held in the pool **P** drains by gravity into outlet passage **92** via port **96**.

The air gap conduit or tube **70** of the air gap structure **60** is defined from a J-shaped hollow tubular conduit member. The tube **70** comprises a first end **72** that is received with a close friction fit in the outlet port **86** of the waste water inlet passage **82**. The air gap tube **70** further comprises a second end **74** that is vertically aligned with but spaced from the pool **P** and preferably also is aligned with the inlet port **96** of the waste water outlet passage **92**. As such, liquid flowing from second end **74** of tube **70** flows into the pool **P** and drains therefrom via port **96** and outlet passage **92** of outlet nipple **90** (of course a drain conduit is connected to the outlet nipple **90** to flow the waste water therefrom to a drain or other location).

An "air gap" (i.e., an open space) is thus defined between the second end **74** of the air gap tube **70** and the waste water inlet port **96**, i.e., waste water that flows into the waste water inlet passage **82** and through the tube **70** must move through the open space defined between the second end **74** of the tube **70** and the inlet **96** of the waste water outlet passage **92**. The air gap tube **70** is engaged with the recessed distal end **62** of the support member **61** so that the support member **61** holds the tube **70** in the described operative position. The air gap tube **70** is secured in the described operative position by adhesive or a friction fit or otherwise. Although the air gap tube **70** is shown herein as a separate metal conduit member that is connected to the body **52**, the air gap tube **70** can alternatively be defined as an integral and/or one-piece part of the body **52** without departing from the overall scope and intent of the present invention.

With continuing reference to FIGURES 6-11, the modular air gap body **52**

further defines a through-bore **100** dimensioned and positioned to receive the mounting tube **MT** as shown in FIGURE 5B. A wall **100w** surrounds the through-bore **100** so that liquid in the pool **P** cannot flow into the bore **100**, i.e., the wall **54w** defines an outer wall of the pool **P** while the wall **100w** defines an inner wall of the pool **P**.

The modular air gap device **50** is selectively installed in the air gap chamber **40** of faucet body **20** when use of an air gap device is required as shown in FIGURE 5B. More particularly, the modular air gap device **50** is slidably installed into the chamber **40** with the mounting conduit **MT** inserted into the bore **100** of the air gap body **52**. On the other hand, if no air gap function is required for a particular installation, the faucet body **20** is usable without having the modular air gap device **50** operatively installed as shown in FIGURE 5A.

It is important to note that the modular air gap device **50** is releasably installed in the chamber **40** and is removable therefrom as desired. Also, of course, the bore **100** is only one example of a structure for accommodating the mounting tube **MT** when the modular air gap device **50** is operatively installed, and the air gap body **52** can be otherwise conformed without the bore **100** so that it is receivable into the mouth **42** of the chamber **40** adjacent the mounting tube **MT** as described.

Referring to FIGURES 3 and 4, the mouth **42** of air gap chamber **40** is preferably defined to include a recess or counter-bore **43** that receives the flange **56** of the air gap device **50** so that the flange **56** is flush with or recessed into the first end **44** of the body (see FIG. 5B). The flange **56** abuts a shoulder **45** formed by the inner end of the counter-bore **43** when the air gap device **50** is fully installed into the chamber **40**. As such, in the preferred embodiment as illustrated, only the nipples **80,90** of the air gap device **50** are located external of faucet body **20** and these are not visible when the faucet assembly **F** is operatively installed in a sink **S** or other

location such as a countertop, i.e., all portions of air gap device **50** located between the first end **44** of the faucet body **20** and the inlet **22** of faucet body **20** are located within the air gap chamber **40** so as not to be visible above the sink **S** or other mounting structure.

Referring now to FIGURES 13-16, an alternative modular air gap device formed in accordance with the present invention is illustrated generally at **150**. Except as shown and/or described, the modular air gap device **150** is identical in structure and use to the modular air gap device **50** just described. As such, features of the device **150** that are the same or correspond to features of the device **50** are identified by reference numbers that are **100** higher than those used in FIGURES 1-12; new features are identified with new reference numerals.

The modular air gap **150** includes a molded plastic body **152** comprising a base **154** and a flange **156** that projects radially outward from the base. Extending axially from a first side of the base **154**, the body **152** comprises an elongated air gap structure **160** that defines an interior hollow chamber or reservoir **162** (FIG. 16).

It should be noted that the base **154** defines an annular wall structure **154w** that preferably surrounds the elongated air gap structure **160** and defines a pool **P**. Walls **166a,166b** define opposite ends of the pool **P** so that water will be trapped in the pool **P** and not flow into the opening **200** (which corresponds to the opening **100** shown in FIGS. 1-12) provided for passage of the mounting tube **MT** as shown in FIGURE 16.

The elongated air gap structure **160** defining the chamber **162** defines an inlet **186** and an outlet **187** (FIGS. 15,16) spaced axially from the inlet **186** (in use the outlet **187** is spaced above the inlet **186**). A waste water inlet conduit **180** communicates with the inlet **186** so that waste water flows under some pressure into the chamber **162** via conduit **180** and inlet **186**. When the level of waste water

W (FIG. 16) in the chamber **162** reaches the outlet **187**, the waste water flows out of the outlet **187** and trickles or flows by gravity into the pool **P**. A water deflector **188** is provided externally adjacent the outlet **187** to ensure that water flowing out of the outlet is directed downwardly into the pool **P**. The chamber **162** and water **W** in the chamber **162** muffle noise associated with flow of waste water through the air gap device **150**.

The body **152** further defines a waste water drain **196** that is in communication with the pool **P**. A waste water outlet conduit **190** is in communication with the drain **196** so that waste water in the pool **P** flows by gravity into the drain **196** and conduit **190**. In can be seen that an air gap is thus defined between the outlet **187** of the chamber **162** and the drain **196** as required.

The drain **196** is vented to improve flow and reduce noise. More particularly, a vent passage **197** (FIG. 13) is defined by the body **152**. The vent passage **197** communicates air into the outlet conduit **190** from a location outside the pool **P**.

FIGURE 16 illustrates the modular air gap device **150** installed in a faucet body **20'**. The faucet body **20'** is identical to the faucet body **20** except that it further defines a vent passage **129** that opens to the ambient atmosphere through an opening **128**. The vent passage **129** is located so that it is in fluid communication with the vent passage **197** of the air gap device **150** when the air gap device **150** is operatively installed in the faucet body **20'** as shown. As such, ambient air flows into the waste water outlet conduit **190** through the opening **128**, passage **129** and passage **197** when waste water flows out of the pool **P** through the drain **196** to improve flow and reduce noise or "rumbling."

FIGURE 16 also shows that the mounting tube **MT** passes through the space **200** defined by the modular air gap device **150** when the device **150** is operatively installed in the faucet body. It should be noted that the air gap device **150** is

removably connected to the faucet body **20'**.

Using a modular air gap device **50,150** formed in accordance with the present invention, no portion of the air gap structure **60,160** thereof is located outside of the air gap chamber **40** of the faucet body **20,20'**. As such, the dimensions and appearance of the body **20,20'** are not altered when a modular air gap device **50,150** is installed into the air gap chamber **40**. Only the nipples **80,90; 180,190** are located external to the air gap chamber **40**, and these are not visible when the faucet **F** is operatively installed in a sink **S** or other support structure.

The invention has been described with reference to preferred embodiments. Modifications and alterations will occur to those of ordinary skill in the art to which the invention pertains, and it is intended that the invention be construed as including all such modifications and alterations.